**Earth's Structure and Processes**

**8-3 The student will demonstrate an understanding of materials that determine the structure of Earth and the processes that have altered this structure. (Earth Science)**

**8.3.7 Illustrate the creation and changing of landforms that have occurred through geologic processes (including volcanic eruptions and mountain-building forces).**
**Taxonomy level**: 2.2-B Understand Conceptual Knowledge

**Previous/future knowledge:** Volcanic eruptions as a natural process were introduced in 3rd grade (3-3.8). In 5th grade (5-3.1), volcanic eruptions were explained as to how they affect Earth's oceans and land. Mountain-building forces are new to this grade as is the concept of how these processes create and change landforms. Additional crustal changes due to forces from plate tectonic activity are part of high school Earth Science (ES-3.4).

**It is essential for students to** know that the landforms of Earth can be created or changed by volcanic eruptions and mountain-building forces.

*Volcanic Eruptions*

- Volcanic eruptions are constructive in that they add new rock to existing land and form new islands. Volcanic eruptions can be destructive when an eruption is explosive and changes the landscape of and around the volcano.
- *Magma* from the mantle rises to Earth's surface and flows out an opening called a *vent*.
- Magma that reaches Earth's surface is known as *lava*.
- The vent as well as the mountain that forms around it from cooled lava, ash, cinders, and rock is called a *volcano*.
- Most volcanoes occur along plate boundaries; an area in the Pacific Ocean where volcanoes are common is called the Ring of Fire.

*Mountain-building forces*

- Forces, or stresses, that cause rocks to break or move are:
  - *Tension*—forces that pull rocks apart
  - *Compression*—forces that push or squeeze rocks together
  - *Shearing*—forces that cause rocks on either side of faults to push in opposite directions
- Forces or stresses (for example, *tension* and *compression*) on rocks in the lithosphere can cause them to bend and stretch.
  - This bending and stretching can produce mountain ranges.
  - If pressure is applied slowly, *folded mountains* form.
- Forces or stresses (for example, *tension*, *compression*, or *shearing*) great enough to cause rocks to break can create *faults*. Faults are places in Earth where the rocks break. There are three types of faults:
  - *Normal fault* – caused by tension forces
  - *Reverse fault* – caused by compression forces
  - *Strike-slip fault* – caused by shearing forces
- If normal faults uplift a block of rock, a *fault-block mountain* forms.

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**It is not essential for students to** know the various types of volcano cones and how they form or the landforms that result when magma fails to reach the surface. The formation of anticlines, synclines, and plateaus are not essential at this time.

**Assessment Guidelines:**
The objective of this indicator is to *illustrate* the creation and changing of landforms due to volcanic eruptions and mountain-building forces; therefore, the primary focus of assessment should be to give illustrations of these concepts or use illustrations to show understanding of landforms resulting from volcanic eruptions and mountain-building forces through diagrams, pictures, and word descriptions. However, appropriate assessments should also require student to *interpret* diagrams that show varying aspects of these concepts; *compare* the various stresses and the resulting landforms; or *recognize* the basic components of a volcano's structure that contribute to the creation or changes of the landscape.